Soil Conservation

January 1977

U.S. Department of Agriculture

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From the Administrator

Soil Surveys: Made to be Used

Thanks to new technology and better management, production of the National Cooperative Soil Survey is on schedule for the first time in many years.

We also are producing more surveys than ever. As recently as 1970, we sent only 40 completed surveys to the printer. In fiscal year 1976, we sent off 101 surveys, and our target for this year—FY 1977—is a record 150 surveys.

We have reduced the time between completion of the survey and its appearance in published form. The lag used to be as long as 7 years. We have reduced that lag time considerably, and have demonstrated that we can achieve our goal of publishing a survey within a year of its completion.

It has taken many changes and innovations to speed up our publishing program. For example, we are now using the most up-to-date word processing techniques available to prepare survey manuscripts for the printer. SCS typists transfer manuscripts to magnetic tapes after the first editing. Subsequent editorial changes are made on the tapes, which are processed to run a photocomposition machine at the U.S. Government Printing Office that sets type automatically. What used to take days to accomplish is now completed in a matter of minutes.

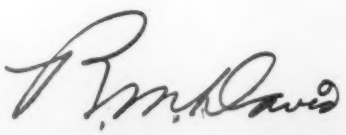
We also have made soil surveys easier to use. Detailed descriptions of each type of soil, largely of interest to soil scientists, are in one section of each publication. Interpretations of mapping units and interpretative tables, which show the behavior of soils for various practical uses and are of interest to most readers, are contained in another section.

With all these innovations in production taking place, it is time we began streamlining the publicity, distribution, and use of surveys.

While the soil survey is in progress, conservation district supervisors, SCS employees, and all who participate in the survey need to make plans for getting it understood and used by the ultimate consumer. That means farmers, ranchers, builders and developers, state and local agencies—everybody concerned with soil and water.

Presentation ceremonies, television and radio shows, meetings sponsored by various organizations, feature stories in local newspapers—all are necessary to help people understand how to use these valuable surveys.

The right kind of promotion may require hard work and long hours for a few weeks, but that is a small investment compared to the hours and dollars that go into producing each survey. A soil survey is of no use to anybody stored in a carton or gathering dust on a shelf.



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Secretary of Agriculture

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Cover:
Conservation practices as seen from the air often create striking patterns—like this terrace system in Iowa, designed to slow down rain runoff and protect soil from washing. (See page 12 for picture story.)

Soil Conservation

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Marine biology field trips are part of environmental studies program taught by award-winning Biloxi High School teacher Della McCaughan.

A national awards program to recognize innovative conservation education projects drew a wide variety of entries. Winners will be honored next month.

From Coastline to Classroom

A New Hampshire teacher and an Oklahoma conservation district took top honors in the 1976 Environmental Conservation Education Awards Program, sponsored by the National Association of Conservation Districts (NACD) and Allis Chalmers.

Mrs. Lillian Scranton of Claremont, New Hampshire, was named Conservation Teacher of the Year, a $1,500 award. Mrs. Della McCaughan of Biloxi, Mississippi, won the $300 second place award.

Pontotoc County Conservation District (CD), Ada, Oklahoma, won the district award for excellence in environmental education, $1,500. Second place in the district category went to York CD in South Carolina, $300.

The national winners will be honored during the annual NACD conference, February 6-10, 1977, in Atlanta, Georgia.

In announcing the national and regional winners for 1976, George Bagley, NACD president, commented on the high standards set by this year's nominees, adding that these should serve as an inspiration for future projects. The national awards program, initiated 3 years ago, is designed to recognize superior programs and innovative projects by teachers and districts and to encourage stronger efforts in environmental education throughout the nation.

Selection of national winners begins with district and state eliminations, followed by judging at the regional level. From the regional winners a panel of resource specialists and educators determines first and second place national awards.

National Winners

Mrs. Scranton was nominated by Sullivan County (New Hampshire) CD under the leadership of Chairman Arthur Leavitt. She teaches 9th grade environmental studies at Stevens Annex School in Claremont. Her

primary objective is to "develop a more conservation-minded citizenry." Mrs. Scranton emphasizes individual responsibility in conservation decisionmaking based on scientific understanding of resource relationships.

An outdoor classroom developed by Mrs. Scranton and her students serves as a learning laboratory for all grades and many disciplines in the Claremont school district.

Mrs. Della McCaughan, national runner-up for Conservation Teacher of the Year, was sponsored by the Harrison County Soil and Water Conservation District (SWCD). Ten years ago she inaugurated a program in marine biology to broaden the scope of environmental studies in Biloxi High School. The program, which focuses on coastal ecosystems and marine life, attracted nationwide attention and has been adopted by several other states. This year Mrs. McCaughan received a citation from National Science Teachers Association for distinguished service to science.

The first-place district, Pontotoc County CD, is chaired by B. M. Stephens. He worked with teachers and district leaders to develop a program that involves elementary to graduate students and includes teacher workshops, curriculum materials development, outdoor classrooms, and adult education. The district employed a former teacher, Dan Sebert, as environmental education consultant to help develop the program. The program is now being extended to schools throughout the state and funded by the Oklahoma Conservation Commission.

Second place district winner, York CD, led by Chairman L. H. Hicks, gave priority to developing land use plans on school property. In a special 1-day project at Clover High School, the district organized community workers and heavy machinery to reshape 110 acres of land into a model school site with an outdoor learning center. A 16mm film, "Now You're in Clover," that resulted from the project, was shown at the 1975 NACD meeting in Hawaii and is now being distributed nationwide. York

Teacher of the Year Lillian Scranton reviews her school's conservation plan with Stan Rastallis, Sullivan County (New Hampshire) CD supervisor.

Pontotoc CD board members B. M. Stephens (left) and Walter Woolley, Jr., visit class that carved jack-o'-lanterns from pumpkins grown in school's new outdoor classroom, one of many developed with the Oklahoma district's help.

A 1-day community project organized by South Carolina's York CD turned 110 acres into a model school site complete with an outdoor learning center.

CD also sponsors an active youth commissioners group that works with elementary and high school classes and has developed a variety of education and information programs.

Regional Winners

The Upper Mississippi Region chose David L. Casteel of Champaign, Illinois, as Teacher of the Year. He was sponsored by Champaign County SWCD, Kenneth M. Kesler, chairman. Casteel teaches an elective environmental science course at Centennial High School in Champaign. He emphasizes "ecologically sane alternatives in solving environmental problems." Casteel, who is chairman of the science department, also advises a student Conservation Club that assists a district-sponsored outdoor classroom used by several schools.

Jasper County Soil Conservation District (SCD), Iowa, was the Upper Mississippi regional district winner. With initial funding from the U.S. Department of Health, Education, and Welfare, Office of Education, the district employed an environmental coordinator, Michael Gross, to prepare environmental teaching units for fifth and sixth grades. The local school district and county officials are now jointly funding this program. District chairman is Gilbert Caldwell.

Southwestern Region Teacher of the Year is Jack L. Anderson of Littleton, Colorado, sponsored by West Arapahoe CD, John W. Race, chairman. Anderson teaches seventh and eighth grade life science classes at Isaac Newton Junior High School and leads several summer field trips each year.

A joint entry of Blacksmith Fork SCD and North Cache SCD, Utah, won the Southwestern regional district award. The districts featured workshops for teachers and field trips for students. Jay Bankhead is chairman of Blacksmith Ford SCD, and Valden T. Pitcher is the North Cache chairman.

Pacific Region Teacher of the Year is Gerald Stoops, junior high school teacher in San Bernardino. He was nominated by Redlands-Highland-Yucaipa Resource Conservation District (RCD) for his work with students on several beautification projects. Frank Jacinto is district chairman.

Topanga-Las Virgenes RCD, California, is the Pacific Region's winning district. Mrs. Helen Funkhouser is chairman. A large ranch owned by J. Grant Gerson, a district director, has been developed as a summer resident camp and is now an official center for Outdoor Biological Instructional Strategies (OBIS), part of the National Science Foundation program. With district help, an outdoor classroom guide and a conservation study guide to Tapia Park in Malibu Canyon have been provided for teachers.

The Northern Plains Region chose two Teachers of the Year. Bruce Kron and Larry Stranahan, high school teachers in Havre, Montana, were sponsored by Hill County CD, Leroy Keller, chairman. Their program includes a life science course and a 10-day summer field trip to study various ecosystems in the state.

The Northern Plains regional district winner is the Central Platte Natural Resources Conservation District, Nebraska. The district's environmental education program has three main objectives—a continuing series of teacher training workshops, development of classroom materials, and a planned Educational Television series. John Jefferson is district chairman.

Mrs. Scranton, this year's national Conservation Teacher of the Year, represented the Northeastern Region. The region's winning district is New Castle CD, Delaware. Josef A. Burger, chairman, and other district leaders worked with the Delaware State Department of Public Instruction and the 12 local school districts to develop school-site outdoor classrooms. They established Del Ray conservation clubs in local high schools with the cooperation of the Delaware Nature Education Society. The district also assisted in rehabilitating several urban parks—that had been severely vandalized—with labor supplied by local young people in a combination environmental learning-work project.

South Central Region Teacher of the Year is Mrs. Pat Kellogg of Ada, Oklahoma. She was sponsored by Pontotoc County CD, the national first-place district. Mrs. Kellogg is a sixth grade teacher at Ada Middle School. Her multidisciplinary program emphasizes learning by doing in the outdoor classroom.

Mrs. Della McCaughan and York CD, second-place national winners, represented the Southeastern Region.

Growing corn through a cover crop of bromegrass is one of several no-till systems under study by USDA's Agricultural Research Service at Morgantown, West Virginia.

by Hubert W. Kelley

Conservation Tillage: Hazards Ahead?

Scientists and conservationists conferred for a day in Washington, D.C., to explore the virtues and risks—and the riddles—of minimum tillage systems.

I know a farmer in Delaware . . . who turned his back on his corn fields for just a few days—and cutworms ate up 200 acres before he noticed.

Conservation tillage systems are here to stay, but they will require more careful management by farmers than "clean-till" systems.

That was one conclusion of a scientific conference held Nov. 22 in Washington, D.C., to explore the virtues and hazards—real, suspected, and imaginary—connected with minimum tillage.

The meeting was called jointly by the administrators of the Soil Conservation Service and Agricultural Research Service (ARS), with Dr. Harold L. Barrows, ARS deputy assistant administrator, as chairman. It was attended by ARS, SCS, and Extension Service personnel.

In opening the conference, an SCS spokesman said that with more than 39 million acres farmed in 1976 under some form of minimum tillage system, "it is time we took a hard look at the pros and cons of these tillage systems to determine if any serious environmental problems lie ahead."

Conservationists are excited about no-till, for example, the SCS staffer said, because it reduces the erosion rate on many soils from 5, 10, or even 20 tons per acre to less than a ton.

"If no-till can be continued on many hard-to-manage soils," he said, "it will mean that the life of the topsoil can be measured in millenniums instead of decades or centuries."

He noted that reductions in energy use also can be achieved by reducing tillage.

He pointed out, however, that a number of adverse impacts have been attributed to conservation tillage, including higher insect and rodent populations; higher incidence of plant disease; more runoff of soluble phosphorus; higher herbicide runoff; and delayed germination of seed during cool, wet springs.

ARS scientists representing several disciplines explored the various hazards. Walter G. Lovely cited the need for better crop management.

Allows Few Errors

"Clean-till lets a farmer make the maximum number of mistakes with a minimum impact on yield," Lovely said. "He can always correct his errors in another trip over the field. But with conservation tillage, he can't do that. A farmer should understand that if he goes the conservation tillage route, he will have much less room for error."

Agronomist William Raney agreed. "I know a farmer using minimum tillage in Delaware," he said, "who turned his back on his corn fields for just a few days—and cutworms ate up 200 acres before he noticed. These new farming systems require

Clean-till lets a farmer make the maximum number of mistakes with a minimum impact on yield. With conservation tillage, he will have much less room for error.

much more careful surveillance than conventional tillage."

Raney believes that researchers need to concentrate efforts on raising crop yields under minimum tillage, "because a farmer won't accept something new unless yields are as high or higher than the old system."

Leon Kimberlin, SCS chief agronomist, pointed out that on many soils there already are good opportunities for high yields with minimum tillage. The 1975 record corn yield of more than 300 bushels per acre, for example, was established with conservation tillage by an Illinois farmer, he said.

Must Control Weeds

Warren Shaw, an authority on weed control, said that total control of unwanted plants is essential to development of high-yielding farming systems.

Shaw said that chemical weed control is responsible for at least 10 percent of the increase in total farm production since 1940 and insisted "there is no turning back" from the use of chemicals.

"I see no possibility of reducing chemicals in agriculture today," Shaw declared. "The question is not should we use them, but rather how much, how safely, how effectively, how economically." He called fuel savings in using chemical weed control "very substantial."

He said that a no-till cropping system may require from 6 to 11 different herbicides for success today. He added, however, that the best way to control weeds is through an "integrated weed management system" involving not only chemicals but also pathogens, water control, and cultural control.

"I know of no instance where the best mixture of practices isn't better than any single method of control," Shaw explained.

"We must continue to examine carefully herbicide, fertilizer, and other agricultural chemical uses in which risks could outweigh benefits," Shaw said. "When this has been done, using acceptable scientific criteria, if the risks remain questionable, such chemical uses should be discontinued and replaced with safer alternatives. If such alternatives are not available, researchers should develop them."

All the ARS researchers observed that the chief deterrent to surface residue tillage at present is the farmer's fear that his neighbors will scorn him for having "trash" on his field.

"For many producers," said one researcher, "a clean, well-tilled field is the same thing as good farming."

And Shaw exclaimed: "It's impossible to interest a farmer in no-till when he's just bought a disk as wide as this conference room."

Cuts Soil Losses

Scientists also discussed higher soluble phosphorus levels in runoff water. R. F. Follett said there is no question that soil erosion is reduced on many soils with no-till farming. He cited a 1973 study showing that soil losses totaled 13.1 tons per acre per year on a field of soybeans under conventional tillage. Under a no-till system, soil losses were cut to 0.16 tons per acre.

Total phosphorus in the runoff water also is reduced under a no-till system, Follett said, particularly in phosphorus linked to sediment particles. In a study in northern Mississippi, however, there was an increase in the amount of soluble phosphorus in runoff water. (See table this page.) When the sediment-linked P and soluble P were added together, however, there was a significant overall reduction in phosphorus in runoff in the no-till systems.

Populations of army worms, a serious pest of soybeans, corn, and other crops, appear to increase under minimum tillage and no-till, according to entomologists and farmer observers.

At left, Spalding County, Georgia, farmer Phil Ogletree, Jr., sprays a cover crop of rye with herbicide to kill it before planting corn in the mulch.

Phosphorus Losses (Pounds/Acre)—1973

Crop	Tillage Method	P in Solution	P tied to Sediment	Total P Losses
Soybeans	Conventional	0.12	15.6	15.7
Soybeans	No-till	1.6	0.9	2.5
Soybeans-wheat	No-till	1.9	0.7	2.6
Soybeans-corn	No-till	0.5	5.6	6.1
Corn-soybeans	No-till	2.0	1.9	3.9

The best way to control weeds is through an integrated weed management system involving not only chemicals but also pathogens, water control, and cultural control.

Four explanations were offered for the increase in soluble P on the no-till fields:

1. Additional P applied in double-cropping soybeans and wheat.

2. Lack of sorption of fertilizer P by the soil.

3. Lack of inorganic sediments to sorb P from solution.

4. Leaching of P directly from the crop residues.

Raney said that, in his opinion, practically all of the additional phosphorus came from the last source—the plant residues themselves.

In a discussion of increased insect pest hazards, Robert D. Jackson noted that there is not much up-to-date entomological research in the minimum tillage area. Much of what is known about higher insect populations on no-till fields, he said, is based on reports of county agents.

Favors Some Insects

But Jackson did not doubt that surface residues were contributing to more insect damage, particularly to corn, and that it would take more insecticides to control the pests in the future.

He reported an increase of black cutworm in no-till corn, particularly when the corn followed a crop of soybeans. Jackson said the cutworm favored low, wet areas and had an affinity for soybean trash.

No-till also favors the seed corn maggot and, to a lesser extent, seed corn beetle. Both are particular problems during cold, wet springs.

Also a hazard are root aphid and white grubs. Many of the latter used to be killed off when fall plowing exposed them to the winter weather.

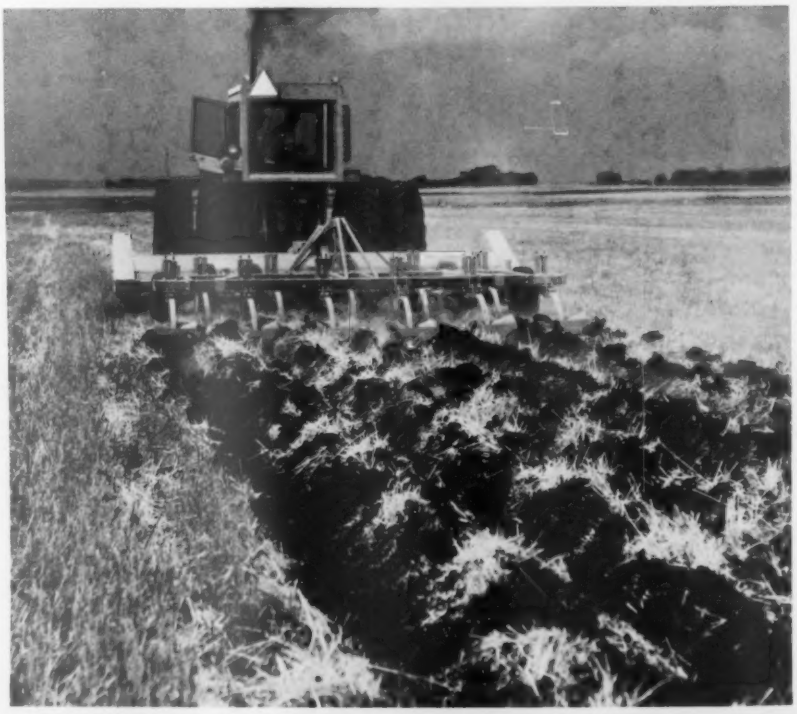
The entomologist said that his profession had predicted an increase in wireworm on no-till fields, but feels the threat has not yet materialized. Jackson speculated that the continued presence of persistent pesticides in the soil is holding down the wireworm, but that populations will build up slowly.

Corn rootworms were something of a puzzle, said Jackson. In Ohio, four times as many rootworm eggs were laid in no-till fields as in clean-tilled, but it took four times as many eggs before the same amount of damage resulted. He called the evidence "inconclusive."

He did note, however, that one cultural practice now used for cutting down on corn rootworms is impossible with no-till.

"If we plant corn in visible rows," said Jackson, "we can identify next season where they were and plant new rows halfway between the

In Johnson County, Illinois, no-till corn pushes up through wheat stubble, which serves as a moisture-holding mulch and helps prevent soil erosion.



Chisel plow leaves residue of small grain stubble in Minnesota field. Rough tilling helps keep soil from blowing and reduces the number of tillage operations, thus conserving fuel.

Conservationists are excited about no-till . . . because it reduces the erosion rate on many soils from 5, 10, or even 20 tons per acre to less than a ton.

old rows. Since corn rootworms lay eggs at the base of the plant, we can reduce damage about 60 percent by this simple practice. But with no-till, it's difficult to locate the old rows."

Army worms are another corn pest that is "clearly on the increase in no-till," he declared, "and higher populations of slugs and flea beetles also have been reported."

Jackson said that farmers should be prepared to increase the amounts of insecticides applied to fields if they expect to enjoy the benefits of no-till, but that they should expect more pollution, after heavy rains, particularly when granular pesticides have been applied.

Disease Study Needed

More research also is needed on plant diseases and minimum tillage, but William M. Dowler said that such research "is always a long-term thing and we never know right away about the results of various new tillage practices. No-till is a new ball game."

Dowler said plant pathologists were "very apprehensive" about the chances of disease on no-till corn, but that so far these apprehensions haven't been realized. Two "minor" diseases of corn have increased—gray leaf spot and leaf spot of corn. Southern corn blight has not proved a problem and stalk rot afflicts more corn in conventionally tilled fields.

Scientists agreed that much more research was needed in the whole field of conservation tillage to supply farmers and soil conservationists and county agents with complete, integrated tillage systems. Lovely said these systems should include recommendations for all parts of the farming system—not just the soil and water management or energy-saving management aspects.

"If we sell systems to farmers, we'd better be sure we have all the answers they need—not just a partial package," Lovely insisted.

Raney agreed. "We scientists are still guilty of provincialism," he said. "We need to talk to other disciplines much more than we do now."

Conference Speakers

The following scientists, all of the ARS National Program Staff, spoke at the November 22 minimum tillage conference:

William M. Dowler, staff scientist, Soil, Water, and Air Sciences Staff.

Ronald F. Follett, staff scientist, Soil, Water, and Air Sciences Staff.

Robert D. Jackson, staff scientist, Plant and Entomological Sciences Staff.

Walter G. Lovely, staff scientist, Plant and Entomological Sciences Staff.

William A. Raney, staff scientist, Soil, Water, and Air Sciences Staff.

Warren C. Shaw, staff scientist, Plant and Entomological Sciences Staff.

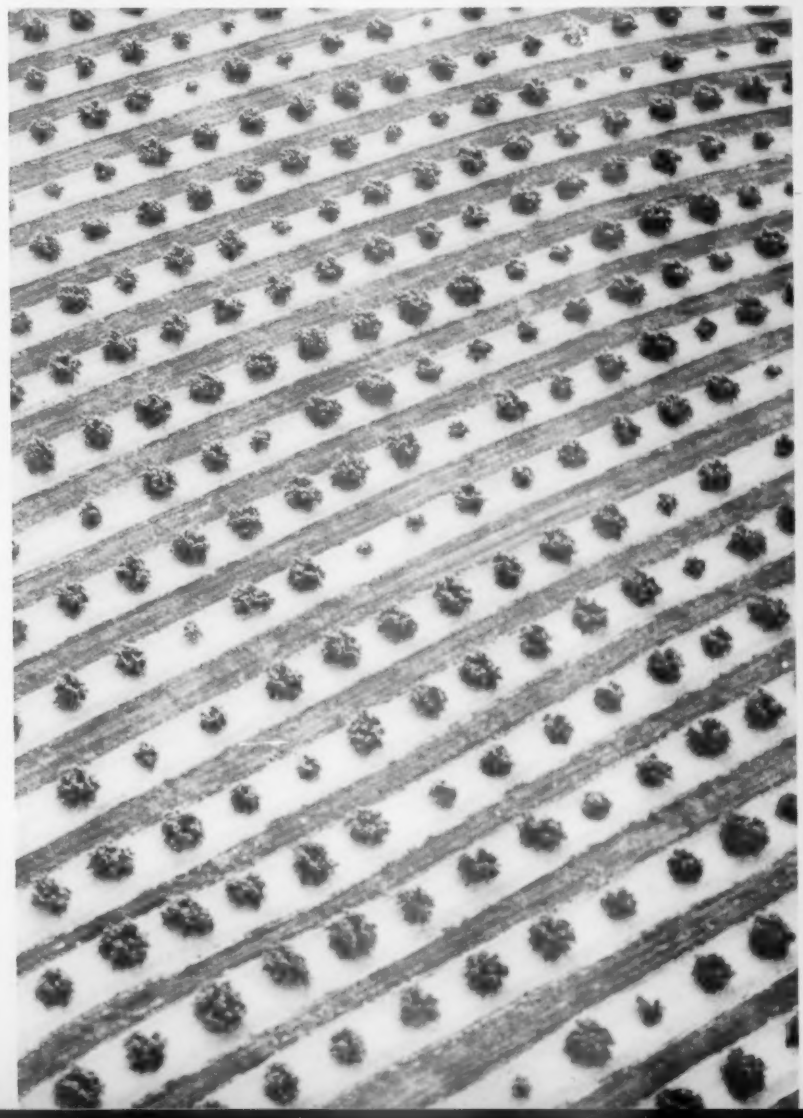
Mr. Kelley is Director, Information Division, SCS, Washington, D.C.

Dr. Orus L. Bennett, an ARS researcher in West Virginia, compares higher no-till corn with adjacent crop grown under conventional tillage. Both crops received same herbicides and fertilizer amounts.

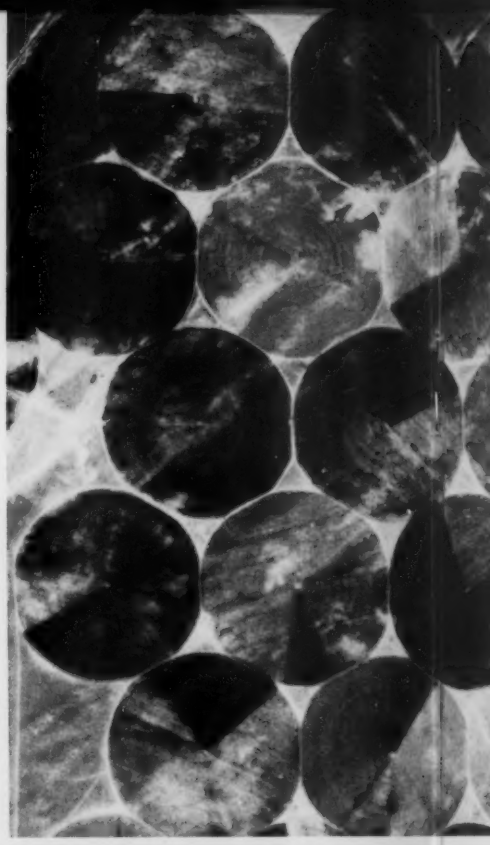
Patterns With a Purpose

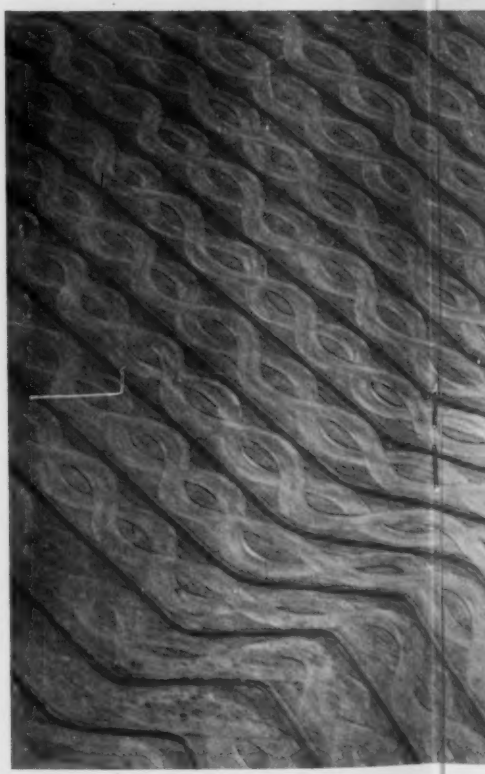
From above, the geometric patterns of today's farmland are puzzling to many people. A commercial airline pilot recently asked an SCS neighbor to identify "those big circles on the ground in Nebraska." On the next few pages are several designs on the land—most of which mean conservation at work.

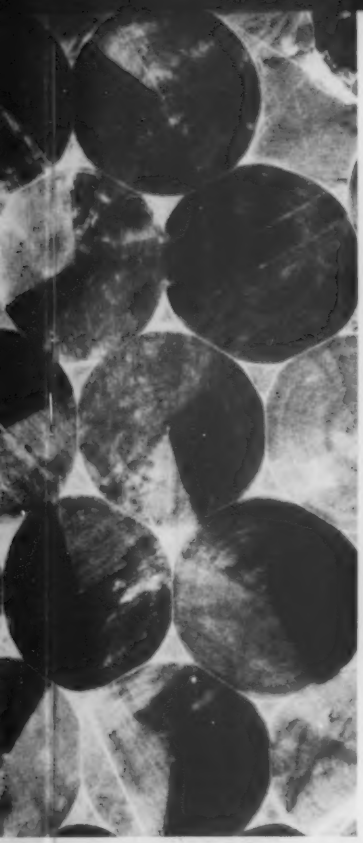
Below, resembling a tufted bedspread, peach trees in New Jersey orchard are separated by strips of clover planted to keep soil from eroding between rows.



At right, water raining down from rotating boom in center pivot irrigation system makes perfect circles of cropland in arid West. Each circle contains 125 acres.

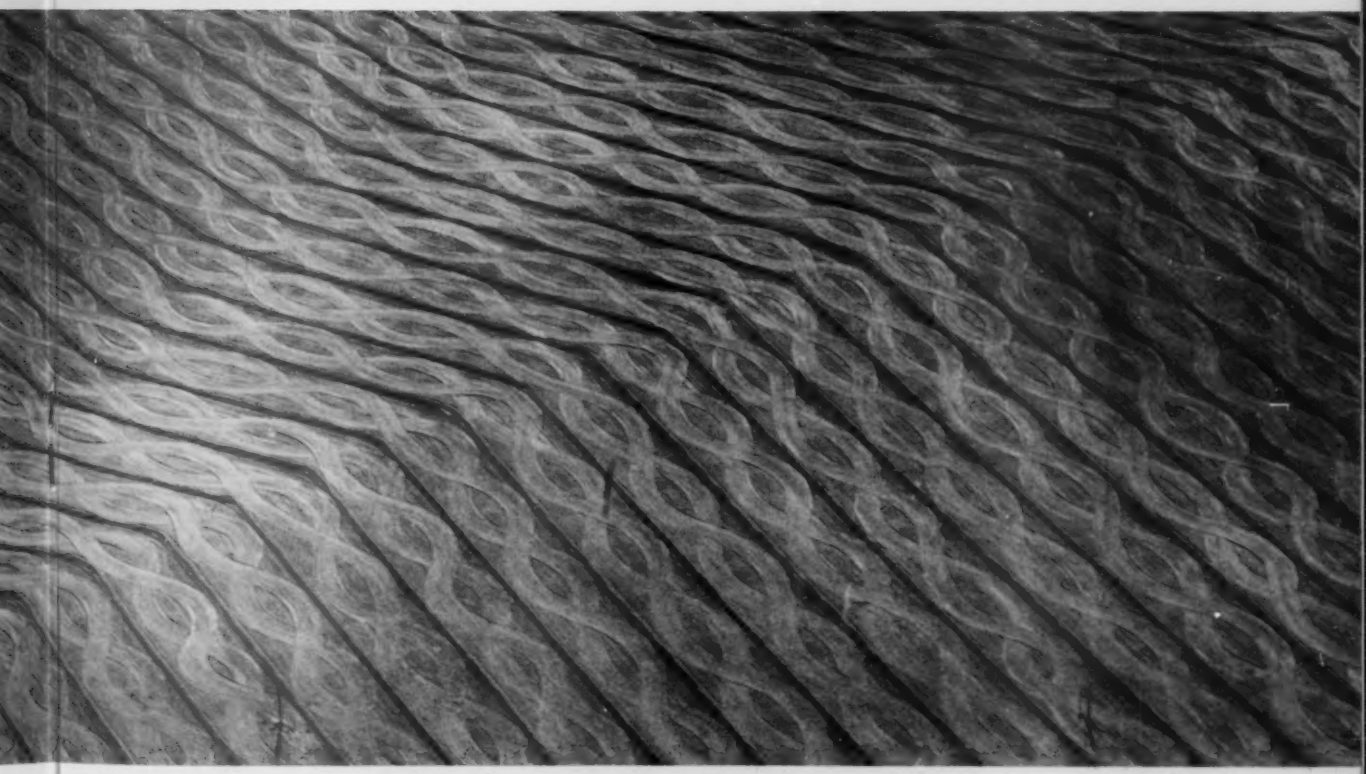






Above, heavy lines show where new underground tile has been laid on Perrydale, Oregon, farm. System will remove excess storm water from fields quickly and safely.

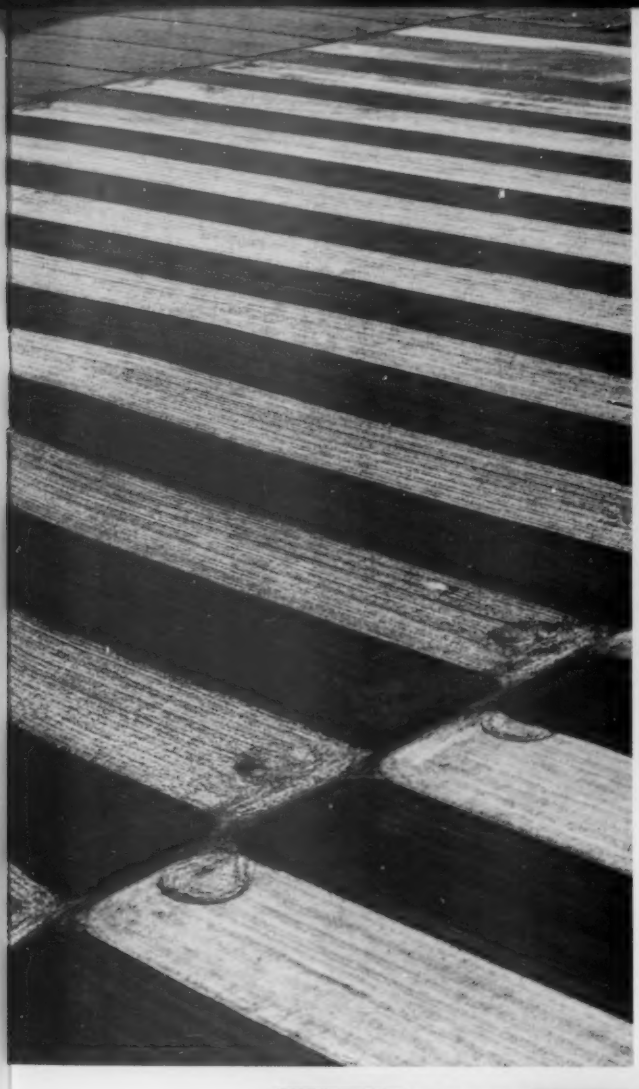
Below, irrigation water will flow down sloping Arizona field between narrow borders. Crisscrossing pattern between borders assures even distribution of water.



Below, in Iowa, rolling fields of corn, soybeans, and small grain are contoured and terraced to trap rain where it falls and to keep soil from washing downhill.

At right, alternating strips of wheat and fallow land are laid out against the prevailing winds on the plains of Montana to reduce soil erosion from wind.

At right, not an aerial view—a glimpse from 4 feet away of strange pedestals of soil left after downpour, each protected from rain by its own umbrella of rock.



Above, parallel terraces, built across the slope of the land on this rolling Texas farm to help prevent soil from washing, can be cultivated with multirow machinery.

Below, on flat farmlands in Michigan, where bluegrass sod is grown, windbreaks of willow trees protect fragile organic soil from blowing until grass comes up.

Banking on Basket Willow

by Wendall R. Oaks

Rapid growth and resilient stems are among characteristics that help make 'Streamco' willow (*Salix purpurea* L.) an ideal erosion control plant for damaged streambanks.

A willow with a new name is finding a new use—as an erosion control plant along streams in the Northeast.

Colonial Americans imported purpleosier willow (or basket willow) from Europe to grow for making baskets. Today the plant has a new name and a new purpose.

The Soil Conservation Service plant materials center at Big Flats, New York, in cooperation with the New York State Department of Environmental Conservation, recently completed tests of the plant for streambank cover—hence the new name, 'Streamco,' an acronyn for STREAMbank COver.

'Streamco' is a medium to tall shrub with smooth, slender branches. The branches are purple when young and later change to gray or olive gray. Its narrow leaves are blue green and 2 to 4 inches long.

Rapid growth, resilient stems, profuse suckering, and ability to recover from mechanical damage make this plant ideal for controlling erosion caused by floods and ice along streambanks.

After tropical storm Agnes ravaged streams throughout the Northeast in 1972, more than 2 million cuttings of 'Streamco' were planted. Survival and growth were good to excellent, with plants reaching 4 or 5 feet in two growing seasons. Mature height (10-20 feet) will be reached in 5 to 7 years.

Either rooted or unrooted cuttings can be used for establishing 'Streamco.' Planting unrooted 'Streamco' is relatively easy: cuttings 9 to 15 inches long and ⅜ to ½ inch in diameter are collected while the plant is dormant. They are planted vertically, leafbuds pointing up, with 1 to 2 inches exposed. This limits the number of buds developing into branches and allows the balance of the cutting to develop roots. Where soils are too stony, cuttings are buried horizontally 2 inches deep in damp soil.

Planting failures occur most often when 'Streamco' is planted alone. In many cases, a combination of structural measures, such as riprap, is needed to provide protection until the plantings are established.

'Streamco' is a multipurpose plant that also provides cover for small animals and deer and food for rabbits and beaver.

'Streamco' purpleosier willow has withstood the test of time as it has changed from a basketmaking material to a successful streambank protection plant.

Mr. Oaks is a soil conservationist, Big Flats Plant Materials Center, SCS, Big Flats, New York.

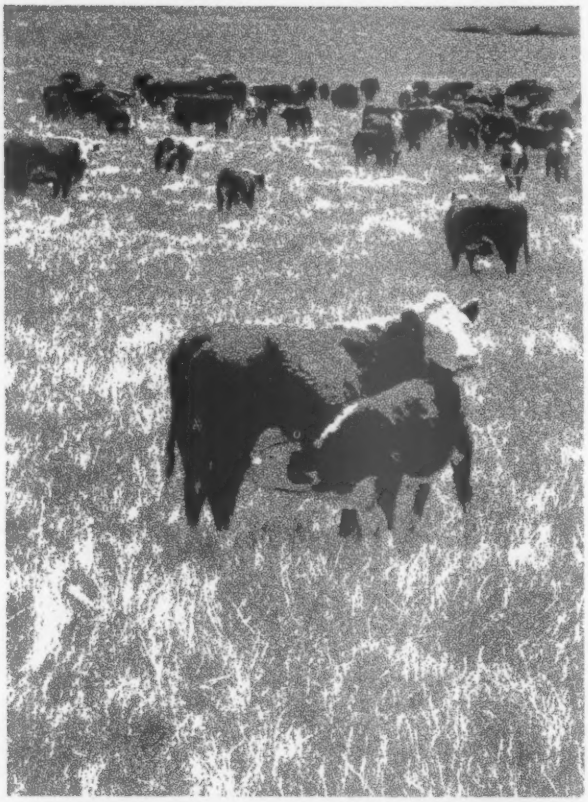
Conservation Highlights 1976

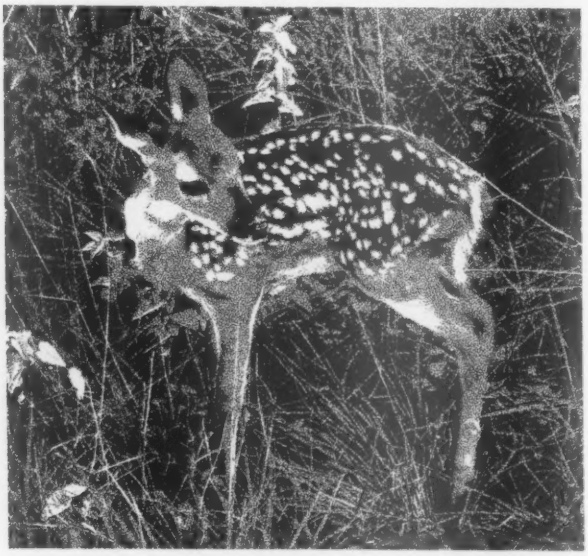
Summary of Activities of the Soil Conservation Service for Fiscal Year 1976

As America's farmers increased plantings to meet production demands at home and abroad, the Soil Conservation Service during fiscal year 1976 stressed the importance of protecting soil and water to meet long-term resource needs.

More than 79,000 new voluntary cooperators signed up with conservation districts during the year ending June 30, 1976, bringing the total to 2,315,005. These include not only farmers and ranchers but also school districts, housing developers, and other public and private land users who are applying and maintaining soil and water conservation practices on 797 million acres of the nation's land.

In giving technical assistance to farmers, SCS professionals recommended varied conservation





practices and systems for preventing soil erosion. Their efforts often were backed by statewide information campaigns.

Minimum tillage, including no-till farming, continues to be the fastest growing conservation practice. It was tried on an additional 2.9 million acres of cropland in fiscal year 1976, for a new total of 39 million acres. The practice conserves energy as well as soil.

The number of parallel terraces, which allow efficient use of large modern farm machinery, increased as well. Some 7,400 miles of parallel terraces were installed in fiscal year 1976, boosting the on-the-land total to more than 100,000 miles.

District cooperators also installed 2.5 million acres of contour farming, 346,690 acres of stripcropping, and 214,894 acres of vegetative cover on critically eroded areas. These practices, along with minimum tillage and terraces, usually were part of an overall conservation system.

Through nearly 3,000 local conservation districts, SCS provided technical assistance to almost 1 million land users during the year. SCS technicians helped prepare more than 62,500 conservation plans covering 23 million acres and helped revise more than 29,000 plans covering 19.5 million acres. Nearly 619 million acres of land in the United States now are covered by conservation plans. With these plans, land users establish conservation systems geared to their needs and the needs of the land for adequate resource protection and wise land use.

SCS technicians also provided onsite assistance to farmers, ranchers, and other land users to make sure that conservation practices were properly designed, installed, and maintained. In fiscal year 1976, SCS provided 2.7 million technical services to land users. SCS also helped some 15,000 groups of land users, such as neighboring landowners or community organizations, with conservation plans and related services.

Conservation Help for Units of Government

SCS employees furnished more than 126,000 services to 30,514 local and state governments during the year. SCS provided basic soil and water data used by local governments in preparing more than 400 regulations concerning land use and control of sediment and erosion. SCS also helped prepare more than 17,000 natural resource inventories and evaluations. Local governments use these to develop quality standards for conservation land use and treatment.

Woodlands and Windbreaks

With SCS technical assistance, landowners planted nearly 258,000 acres of trees, more than 50,000 acres of farmstead and feedlot windbreaks, and more than 2,000 miles of field windbreaks. They prepared 203,909 acres for planting or seeding forest crops and improved another 268,203 acres of woodland. Improved

harvesting was practiced on 905,353 more acres, for a total of 37 million acres nationwide.

Pasture and Range Conservation
SCS helped farmers and ranchers with pasture and hayland plantings on 2.1 million acres during the year, bringing the on-the-land total of improved pasture to more than 77 million acres. They assisted in bringing pasture and hayland management to 9 million acres during fiscal year 1976, for a total of 78 million acres.

In the West, SCS professionals helped ranchers reseed more than 355,000 acres of range, for a cumulative total of 17.7 million acres. They also assisted ranchers in developing planned grazing systems for 6.6 million acres, bringing the total acreage under the systems to 59 million.

Great Plains Conservation Program
During the year, more than 2,000 farmers and ranchers signed long-term contracts to apply permanent conservation measures on 4.2 million acres. Since the program began in 1956, nearly 52,000 farmers and ranchers have signed GPCP contracts covering 94 million acres.

Wildlife
SCS specialists helped landowners improve 12.7 million acres of land and water for wildlife during the year. They also helped landowners convert more than 200,000 acres from cropland and other uses to wildlife and recreation areas. Other conservation measures, such as the 36,000 ponds SCS designed during the year, will benefit wildlife as well.

Recreation
SCS provided technical and financial assistance for establishing or expanding 311 public recreation developments, such as state, county, and local parks. SCS specialists also provided technical assistance to 1,277 landowners establishing or expanding commercial recreation enterprises and to more than 21,000 landowners developing noncommercial recreation facilities.

Water Bank Program
Through the Water Bank Program, SCS provides technical and financial assistance for conserving wetlands in important migratory waterfowl nesting and breeding areas. During fiscal year 1976, SCS assisted land users in preparing 802 conservation plans that support water bank agreements. A total of 3,164 plans covering 1.6 million acres has been developed or revised for water bank agreements since the program was established in 1972.

Water Resources
Small watershed projects under Public Law 566 combine conservation measures on private and public land with dams and other structural measures to reduce floods and provide water supply, recreation, and wildlife habitat. During fiscal year 1976, 29 small watershed projects were completed, bringing to 425 the number completed since the program began in 1954. Ten projects were authorized for planning, bringing the cumulative total to 1,731, and 33 were approved for construction, for a total of 1,157. Construction began on 17 projects during the year. About 9,400 man-years of construction work and related secondary jobs are now being generated, most of them in rural communities with high unemployment.

Nine river basin studies were completed during the year, including one on which the Chicago metropolitan area floodwater management plans are based. A total of 85 river basin studies had been completed as of June 30, 1976. SCS also completed 29 flood hazard analyses and made 14 flood insurance studies for the Department of Housing and Urban Development.

Under Section 216 of the Flood Control Act of 1950, more than $10 million was obligated for emergency streambank stabilization, debris removal, and revegetation to protect life and property after storms and floods caused damage in 22 states.

Environmental Services
SCS filed 44 draft and 80 final environmental impact statements with the Council on Environmental Quality during fiscal year 1976. The agency also commented on some 1,000 environmental impact statements from other agencies and cooperated in numerous environmental assessments throughout the nation.

Resource Conservation and Development Areas
Resource Conservation and Development (RC&D) areas are sponsored by conservation districts, local governments, and other public bodies to advance economic development in adjoining counties by enhancing the environment. During fiscal year 1976, 10 new RC&D areas in 10 states were authorized for assistance. This brought the total number of RC&D areas to 168, involving 1,117 counties in all states except Alaska.

Agricultural Conservation Program
SCS assisted farmers and ranchers in preparing 4,167 conservation plans that serve as foundations for long-term Agricultural Conservation Program agreements. The agreements, which run as long as 10 years, provide cost sharing on selected conservation practices. This year's plans cover 2.4 million acres, bringing the cumulative total to 4.2 million acres.

Soil Surveys
SCS leads the National Cooperative Soil Survey. As of June 30, 1976, more than 1 billion acres had been mapped in the United States, Puerto Rico, and the Virgin Islands to show the location and kind of soil.

Nearly 54 million acres were mapped during fiscal year 1976.

A record 101 soil survey manuscripts were submitted for printing during the year, and 88 surveys were published. At the end of the year, SCS had 961 modern published soil surveys covering 466 million acres.

Snow Surveys

In the West, SCS snow surveyors measure the mountain snowpack in winter to estimate how much irrigation water will be available in spring and summer. In fiscal year 1976, snow surveyors took 5,241 separate snow course measurements and issued 2,406 water supply forecasts.

Progress in automation continued during the year. Remote sensing equipment was installed at 100 more data sites, making a total of 260 automated sites. A contractor began installing a meteor burst system for communication between the data sites and computers in western SCS state offices.

National Water Assessment

SCS continued participation in the Water Resources Council's second national water assessment. Studies show projected water needs for livestock, irrigation, and noncentral domestic water systems for the years 1985 and 2000. Upstream flood damage and cropland erosion rates also are projected for the years 1985 and 2000.

Colorado River Basin Salinity Control Program

Under Public Law 93-320, SCS is cooperating with the Bureau of Reclamation to reduce salt concentrations in the Colorado River, primarily by improving onfarm irrigation efficiency. In the first full year of the Title I program, 27 cost-sharing contracts were signed for irrigation improvements on 4,700 acres. Major practices installed included land leveling with laser beam control, concrete-lined irrigation ditches, and structures for water control and measurement. In fiscal year 1976, Title II salinity control studies were underway in four areas covering some 500,000 acres of irrigated land plus thousands of dryland acres.

Plant Materials

Six new conservation plants were released by SCS with cooperating agencies in fiscal year 1976. Among these are the Midwest's first three certified varieties of native wildflowers, which will be used to control erosion and beautify pasture, range, and roadsides. Other new plants will be used for reclaiming surface-mined land, reseeding range, and stabilizing streambanks. More than 126 kinds of improved plants selected or developed by SCS are now produced commercially for conservation or environmental improvement across the country. Programs at nine SCS plant materials centers have been stepped up to meet an increased demand for plants to reclaim land surface mined for coal.

Summary of Progress, Fiscal Year 1976

Reportable progress in soil and water conservation programs assisted by the Soil Conservation Service

Progress Item		Fiscal Year 1976	Cumulative to June 30, 1976
Conservation Plans and Related Services			
District cooperators	No.	79,065	2,315,005
District cooperators	acres	29,500,756	796,771,784
Land users assisted	No.	998,735	—
Services to land users	No.	2,672,533	—
Land users applying practices	No.	532,445	—
Conservation plans prepared	No.	62,524	1,828,542
Conservation plans prepared	acres	23,029,558	618,921,571
Conservation plans revised	No.	29,097	—
Conservation plans revised	acres	19,499,712	—
Inventories and evaluations prepared	No.	91,033	—
Federal lands under coordinated conservation plans	No.	71	1,158
Federal lands under coordinated conservation plans	acres	699,208	17,047,487
Conservation Help for Units of Governments			
Units assisted	No.	30,514	—
Technical services	No.	126,074	—
Land use and treatment data provided	No.	15,830	—
Resource plans	No.	856	—
Inventories and evaluations	No.	17,201	—
Land use regulations using soil and water data	No.	416	—
Sites for public facility, selected	No.	1,056	—
Sites for public facility, investigated	No.	17,566	—
Agricultural Conservation Program			
ACP referrals serviced	No.	216,066	—
Requests for long-term agreements serviced	No.	5,883	—
Conservation plans for long-term ACP agreements	No.	4,167	8,091
Conservation plans for long-term ACP agreements	acres	2,380,556	4,182,086
Long-term ACP agreements expired or terminated	No.	205	335
Long-term ACP agreements expired or terminated	acres	67,350	108,357
Group Conservation Plans and Related Services			
Groups assisted	No.	14,751	—
Conservation plans prepared	No.	3,029	29,018
Inventories and evaluations	No.	4,893	—
Technical services	No.	73,205	—
Groups applying practices	No.	4,292	—

Progress Item		Fiscal Year 1976	Cumulative to June 30, 1976
Great Plains Contracts			
Applications received	No.	2,411	56,236
Applications received	acres	4,996,383	105,893,829
Contracts signed	No.	2,077	51,778
Contracts signed	acres	4,169,569	94,379,441
Contracts terminated	No.	2,487	37,011
Contracts terminated	acres	4,192,790	60,776,459
Cropland before GP contract	acres	419,681	14,136,251
Planned cropland conversions	acres	72,265	2,961,220
Water Bank Program			
Referrals serviced	No.	1,319	—
Plans developed	No.	802	3,164
Plans developed	acres	352,276	1,634,581
Wetland treatment completed	acres	64,649	—
Soil Surveys			
Detailed soil surveys	acres	43,760,059	910,884,799
Reconnaissance soil surveys	acres	9,769,454	92,665,958
Total surveys	acres	53,529,513	1,003,550,757
Exploratory soil surveys in Alaska	acres	—	352,710,591
Snow Surveys			
Snow course measurements	No.	5,241	—
Aerial snow marker course readings	No.	699	—
Mountain precipitation gauge readings	No.	2,019	—
Sites with remote sensing	No.	172	—
River stations for which numerical forecasts issued	No.	690	—
Interpretive water supply forecasts issued	No.	332	—
Statistical forecasts issued	No.	2,074	—
Recreation Development			
Land owners and operators:			
Establishing first commercial enterprise	No.	814	—
Establishing, expanding, or adding to public recreation developments	No.	311	—
River Basin Studies			
Flood hazard analyses	No.	29	—
Flood insurance studies	No.	14	—
River basin studies completed	No.	9	85

Progress Item		Fiscal Year 1976	Cumulative to June 30, 1976
Watershed Projects			
Applications	No.	22	2,904
Authorized for planning	No.	10	1,731
Approved for construction	No.	33	1,157
Construction starts	No.	17	940
Projects completed	No.	29	425
RC&D Areas			
Applications on hand	No.	—	60
Applications on hand	acres	—	264,325,000
Areas authorized for assistance	No.	10	168
Areas authorized for assistance	acres	38,313,000	704,470,000
RC&D measures completed	No.	1,769	10,533

Watershed and RC&D Project Measures

		Fiscal Year 1976	
		Watersheds	RC&D
Reservoir-type structure sites:			
Investigated	No.	393	129
Surveyed	No.	770	224
Reservoir-type structures:			
Designed	No.	1,082	348
Under construction	No.	1,137	167
Flow control structure sites:			
Investigated	miles	172	57
Surveyed	miles	226	147
Flow control structures:			
Designed	miles	424	111
Under construction	miles	813	155
Fish, wildlife, and recreation developments (public):			
Surveyed	No.	7	11
Designed	No.	17	19
Under construction	No.	18	22
Services provided on land rights, agreements, and contract awards	No.	15,479	2,465

Summary of Progress—continued

Practice		Fiscal Year 1976	On the land—June 30, 1976
Agricultural waste management systems	No.	1,075	6,877
Agricultural waste storage facilities	No.	742	4,714
Bedding	acres	11,919	1,039,593
Brush management	acres	2,752,595	59,344,377
Burning, prescribed	acres	323,203	7,125,341
Chiseling and subsoiling	acres	710,471	12,938,843
Clearing and snagging	miles	316	9,004
Conservation cropping system	acres	16,176,357	225,065,267
Contour farming	acres	2,544,956	50,010,971
Critical area planting	acres	214,894	5,604,860
Crop residue management	acres	14,850,997	188,590,116
Dams, diversion	No.	948	24,507
Dams, multiple-purpose	No.	164	9,014
Dams, multiple-purpose	acre-feet	81,160	26,345,031
Debris basin	No.	1,930	78,761
Deferred grazing	acres	10,837,464	96,564,019
Dike	miles	152	14,078
Disposal lagoon	No.	730	9,447
Diversion	miles	2,424	105,530
Drainage field ditch	miles	4,158	196,934
Drainage land grading	acres	27,550	670,490
Drainage main or lateral	miles	4,529	388,810
Drain, subsurface	miles	31,156	1,025,238
Farmstead and feedlot windbreaks	acres	50,083	946,325
Fencing	miles	3,978	775,259
Field border	miles	926	50,329
Field windbreak	miles	2,260	101,018
Firebreak	miles	2,259	49,603
Fishpond management	No.	44,901	806,641
Fish ponds, commercial	acres	2,376	81,660
Fish raceways	feet	13,235	470,752
Fish stream improvements	feet	160,630	3,839,152
Floodwater diversions	feet	30,645	2,697,320
Floodwater retarding structures	No.	315	12,703
Floodwater retarding structures	acre-feet	202,788	6,954,473
Floodways	feet	129,651	5,321,382
Grade stabilization structures	No.	13,552	283,104
Grassed waterways or outlets	acres	114,785	2,214,022
Grazing land, mechanical treatment	acres	14,456	1,418,069
Heavy use area protection	acres	11,504	287,152
Hedgerow planting	miles	313	22,623
Hillside ditch	miles	57	1,991
Holding ponds and tanks	No.	852	9,916
Irrigation canal or lateral	miles	191	59,548
Irrigation ditch and canal lining	miles	840	37,528
Irrigation field ditch	miles	974	128,607
Irrigation land leveling	acres	231,292	12,679,235
Irrigation pipeline	miles	4,352	196,498
Irrigation pit or regulating reservoir	No.	1,325	49,418
Irrigation storage reservoir	No.	201	40,524
Irrigation storage reservoir	acre-feet	10,651	9,584,731
Irrigation system, drip	No.	330	1,543
Irrigation system, drip	acres	15,188	65,952
Irrigation system, sprinkler	No.	5,496	164,667
Irrigation system, sprinkler	acres	577,927	12,834,859
Irrigation system, surface & subsurface	No.	5,202	189,152
Irrigation system, surface & subsurface	acres	501,322	20,343,679
Irrigation system, tailwater recovery	No.	1,826	22,784
Irrigation water management	acres	2,838,549	25,859,136
Land smoothing	acres	161,434	8,574,569
Lined waterway or outlet	feet	17,990	422,802
Livestock exclusion	acres	568,478	18,180,060
Minimum tillage	acres	2,874,220	39,161,170
Mulching	acres	42,379	1,338,096
Open channels	miles	348	16,971
Pasture and hayland management	acres	8,771,496	78,098,927
Pasture and hayland planting	acres	2,132,347	77,478,552
Pipeline for recreation or livestock	miles	2,443	47,014
Planned grazing systems	acres	6,579,895	59,077,228
Ponds	No.	35,964	2,093,091
Proper grazing use	acres	45,913,641	287,571,006
Pumping plant for water control	No.	2,715	154,161
Range seeding	acres	355,452	17,736,806
Recreation area improvement	acres	40,802	1,577,031
Recreation land grading and shaping	acres	22,969	545,985
Recreation trail and walkway	miles	374	18,341
Road, access	miles	1,533	41,772
Spring development	No.	2,604	154,303
Stock trails and walkways	feet	158,025	23,440,002
Stream channel stabilization	miles	49	1,344
Streambank protection	miles	287	11,472
Stripcropping	acres	346,690	22,596,628
Structure for water control	No.	57,294	2,097,697
Terrace, basin	miles	232	3,495
Terrace, gradient	miles	10,202	712,377
Terrace, level	miles	9,547	423,421
Terrace, parallel	miles	7,407	100,141
Total terraces	miles	27,388	1,239,434
Toxic salt reduction	acres	49,604	1,779,121
Tree planting	acres	257,554	24,831,773
Troughs or tanks for livestock	No.	8,470	625,552
Waterspreading	acres	30,032	1,284,680
Wells	No.	7,293	659,461
Wildlife wetland habitat management	acres	518,677	8,304,481
Wildlife upland habitat management	acres	12,196,345	90,739,727
Wildlife watering facility	No.	688	42,561
Woodland, direct seeding	acres	8,774	776,845
Woodland, improved harvesting	acres	905,353	36,533,151
Woodland improvement	acres	268,203	18,505,307
Woodland pruning	acres	7,258	3,432,531
Woodland site preparation	acres	203,909	6,897,639
Land Treated			
Land protected during development	No.	1,549	19,058
Land protected during development	acres	27,083	473,559
Land adequately treated	acres	24,347,323	—
Land adequately protected	acres	—	1,075,679,850

Touching Down on Conservation

by Soren G. Sabey

The latest fans of soil conservation are sky divers.

Mile upon mile of Cedar Valley, west of Lehi, Utah, is dry-farmed for wheat, hay, and grass. Each year after harvest, the farmers in the area plow half their land under or chisel the soil, leaving crop stubble on the surface to let the soil rest and accumulate moisture.

Sky divers say that the rough-tilled and stubble-mulched fields make a better "cushion" for their "touch down." Jumpers suffer most of their minor injuries when they hit the ground, especially novice parachutists who haven't mastered the perfect "parachute landing fall technique." Plowed fields, they find, are more forgiving than hard ground and cut down on injuries.

Touching down on the "softer" fields brought conservation work to the attention of Jack Atkins, owner of the Cedar Valley Airport Sky Divers facilities. As a result, he requested technical assistance from the Alpine Soil Conservation District in further developing his airport acreage.

Mr. Sabey is a soil conservationist, SCS, Provo, Utah.

Meetings:

January

9–12	American Farm Bureau Federation, Honolulu, Hawaii
9–13	National Council of Farmer Cooperatives 48th Annual Meeting, San Juan, Puerto Rico
10–14	North American Game Breeders and Shooting Preserve Association National Convention, Milwaukee, Wisc.
16–19	National Wool Growers Association—National Lamb Feeders Association Convention, Monterey, Calif.
30–Feb. 5	American National Cattlemen's Association Annual Conventions & Trade Show, Atlanta, Ga.

February

2–5	Catfish Farmers of America, New Orleans, La.
6–10	National Association of Conservation Districts, Atlanta, Ga.
8–12	American Seed Trade Association, Inc., Garden Seed Conference, New Orleans, La.
13–15	Sprinkler Irrigation Association Technical Conference, Salt Lake City, Utah
14–18	Society For Range Management Annual Meeting, Portland, Oreg.
20–25	American Association for the Advancement of Science, Denver, Colo.
22–25	Land Improvement Contractors of America, Orlando, Fla.
23–24	Southern Forest Institute, Inc., Houston, Tex.
25–28	American Association of School Administrators Convention, Las Vegas, Nev.
27–Mar. 5	American Society of Photogrammetry, Washington, D.C.

March

5–9	Association for Supervision and Curriculum Development, Detroit, Mich.
6–8	The Wildlife Society, Atlanta, Ga.
6–9	North American Wildlife and Natural Resources Conference, Atlanta, Ga.
20–25	American Concrete Pipe Association Annual Convention, Las Vegas, Nev.
21–24	Land Use Planning Symposium, sponsored by Soil Conservation Society of America, American Institute of Planners, American Society of Planning Officials, Council of State Governments, National Association of Conservation Districts, and Urban Land Institute, Omaha, Nebr.
21–25	Annual Spring Meeting Hardwood Plywood Manufacturers Association, Cancun, Mexico.
25–27	National Wildlife Federation 41st Annual Meeting, Washington, D.C.

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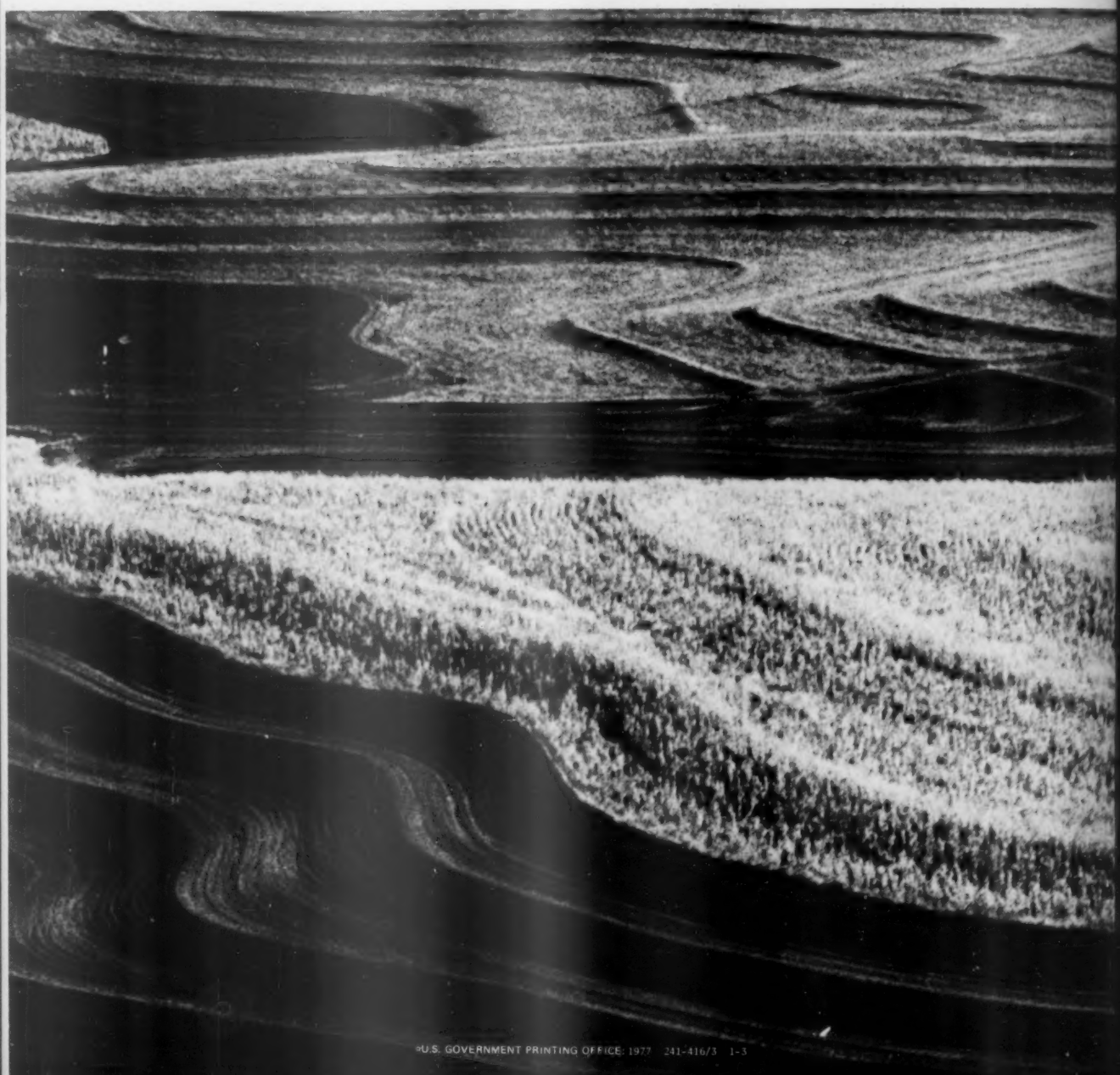

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